Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band	ET Docket No. 13-49

OPPOSITION OF AEROHIVE NETWORKS, INC., BROADCOM LTD, CHARTER COMMUNICATIONS, INC., OPEN TECHNOLOGY INSTITUTE AT NEW AMERICA, PUBLIC KNOWLEDGE, AND RUCKUS WIRELESS, INC. TO PETITION FOR RECONSIDERATION OF THE ASSOCIATION OF GLOBAL AUTOMAKERS AND THE ALLIANCE OF AUTOMOBILE MANUFACTURERS

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I. INTRODUCTION AND SUMMARY

The Association of Global Automakers and the Alliance of Automobile Manufacturers' (collectively "automakers") petition for reconsideration[1] is their second petition seeking to sharply reduce out-of-band emissions ("OOBE") from devices operating in U-NII-3—one of the most heavily used and most important bands for Wi-Fi. The Commission should reject this petition because it fails on both procedural and substantive grounds.

The petition fails on procedural grounds because all parties had ample notice that the Commission was considering revisions to its U-NII-3 OOBE limits and the Commission has already fully and properly considered the issues discussed in the automakers' pleading. Indeed, far from being deprived a meaningful opportunity to comment, the Association of Global Automakers ("AGA") commented extensively on the possibility of interference by U-NII-3 OOBE to DSRC. The FCC should therefore deny the petition on procedural grounds alone.

The petition also fails on substantive grounds. The automakers' petition fails to show any significant error in the Commission's reasoning. Rather, analysis of likely worst-case U-NII-3 emissions confirms the Commission's conclusion that the OOBE rules adopted in the Commission's recent U-NII order[2] provide robust protection for DSRC. The automakers' analysis appears to show otherwise only because it failed to take into account real-world engineering constraints that manufacturers face while seeking to comply with the U-NII-3 mask.

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[1] Petition for Reconsideration of the Association of Global Automakers, Inc. and the Alliance of Automobile Manufacturers, ET Docket No. 13-49 (filed May 6, 2016) ("Second Automaker Petition").

[2] *Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, Memorandum Opinion and Order, 31 FCC Rcd. 2317 (rel. Mar. 2, 2016) ("2016 Order").

Finally, the automakers' requested relief would result in substantial and unnecessary harm to Wi-Fi in the U-NII-3 band. Beyond the petition's procedural flaws and its failure to establish the likelihood of any real-world interference, the Commission can best address the automakers' claimed interference concerns by relocating vehicle-to-vehicle ("V2V") crash-avoidance applications currently confined to channel 172 to a channel in the upper portion of the U-NII-4 band. This is the perfect moment to make this change because we are at the very beginning stages of DSRC crash-avoidance device deployment. Accordingly, such a change would have limited impact on DSRC interests. Furthermore, unlike the automakers' request to reduce U-NII-3 OOBE levels, this solution would serve the FCC's central goal of improving broadband access and increasing spectrum efficiency, since imposing stringent OOBE restrictions on the heavily used U-NII-3 band would be far more burdensome than modifying plans for future DSRC operations in channel 172. Hamstringing millions of consumer Wi-Fi devices today in order to over-protect future DSRC devices when the far more efficient and effective alternative of rechannelization is available would undermine the Commission's efforts.

II. THE AUTOMAKERS' PETITION IS PROCEDURALLY IMPROPER.

The Commission's procedural rules governing petitions are clear: petitions for reconsideration "plainly do not warrant consideration" if they merely repeat "arguments that have been fully considered and rejected by the Commission within the same proceeding."[3] Based on this rule alone the FCC should deny the automakers' petition for reconsideration. Not only does the automakers' petition repeat arguments AGA has already made about the risk of

[3] 47 C.F.R. § 1.429(l).

interference from U-NII-3 OOBE to DSRC, AGA has also already sought reconsideration on this same issue in this same proceeding.[4] The Commission considered AGA's original comments relating to U-NII-3 OOBE[5] as well as its previous petition for reconsideration, and correctly rejected both.[6]

In fact, not only did the Commission reject AGA's petition seeking to tighten U-NII-3 OOBE limits, the Commission agreed with several other petitioners that the previous OOBE limits were unnecessary to protect DSRC and would unnecessarily restrict unlicensed use of U-NII-3.[7] In so doing, the Commission considered contributions from numerous stakeholders, including AGA, and correctly concluded that relaxing the U-NII-3 OOBE mask would not increase the risk of interference to DSRC operations in U-NII-3. The fact that the automakers do not agree with the Commission's conclusion does not justify another reconsideration of the U-NII-3 mask.

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4 Petition for Partial Reconsideration of the Association of Global Automakers, Inc., ET Docket No. 13-49 (filed May 1, 2014).

5 Reply to Oppositions to Petition for Partial Reconsideration of the Association of Global Automakers, Inc., ET Docket No. 13-49 (filed Sept. 2, 2014).

6 2016 Order ¶¶ 17-23; *Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, First Report and Order, 29 FCC Rcd. 4127 ¶¶ 114-120 (2014) ("2014 Order").

7 *See* Mimosa Networks, Inc. Petition for Partial Reconsideration, ET Docket No. 13-49 (filed June 2, 2014) ("Mimosa Petition"); Petition for Reconsideration of Cambium Networks, Ltd., ET Docket No. 13-49 (filed June 2, 2014) ("Cambium Petition"); Petition for Partial Reconsideration of Motorola Solutions, Inc., ET Docket No. 13-49 (filed June 2, 2014) ("Motorola Petition"); Petition for Partial Reconsideration of the Wireless Internet Service Providers Association, ET Docket No. 13-49 (filed June 2, 2014) ("WISPA Petition"); Petition for Partial Reconsideration of JAB Wireless, Inc., ET Docket No. 13-49 (filed June 2, 2014) ("JAB Petition").

Likely recognizing the procedural weakness of their petition, the automakers attempt to muddy the waters by asserting that Commission staff made a procedural error by somehow failing to provide them with adequate notice that it might adjust the U-NII-3 OOBE limits for all devices, and not just point-to-point operations.[8] This argument finds no support in the record. Indeed, it was perfectly clear to parties that the Commission might change the U-NII-3 mask for all devices. This is why, for example, Broadcom continued to participate in the proceeding, seeking to ensure that the new U-NII-3 mask would not strand existing investments in Wi-Fi technology.[9] This fact evidently was clear to Intel as well, which also raised issues with the implementation of the existing U-NII-3 mask for non-point-to-point devices.[10]

These commenters, and others, knew that the Commission might revise its U-NII-3 OOBE rules for all U-NII-3 devices because that is precisely the relief requested by several of the petitions for reconsideration that precipitated the order that the automakers now challenge. Although some parties chose to focus their arguments on the harmful effects on point-to-point devices of the OOBE limits adopted in that previous order, the relief those petitioners requested was for the Commission "to retain the existing unwanted emission limits described in Section 15.247"[11]—i.e., to restore the previous U-NII OOBE limits, which were more permissive for both point-to-point and non-point-to-point devices than the rules the Commission had adopted in

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[8] Second Automaker Petition at 6-7.

[9] Letter from Paul Margie, Counsel to Broadcom Corporation, Harris, Wiltshire & Grannis LLP, to Marlene H. Dortch, Secretary, FCC, Attachment at 2, ET Docket No. 13-49 (filed Jan. 25, 2016) ("Broadcom Letter").

[10] Letter from Peter K. Pitsch, Executive Director, Communications Policy, Intel Corporation, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49 (filed Nov. 6, 2015).

[11] JAB Petition at 1. *See also* Mimosa Petition; Cambium Petition; Motorola Petition; WISPA Petition.

its First Report and Order. It is conceivable that the Commission could have addressed these petitions in many ways, including by creating separate rules relevant to OOBE for point-to-point and non-point-to-point operations, basing rules on device operations in rural areas or other geographic considerations, differentiating fixed devices, or any number of other permutations. But nothing in the Administrative Procedure Act or the Commission's rules required the Commission to limit its 2016 Order in these ways, and it was not reasonable for the automakers to unilaterally assume that the Commission would do so, especially when the previous petitioners did not so limit their requests for reconsideration.

In short, the Commission's decision to modify OOBE limits for all U-NII-3 devices is consistent with the record, and no more than the relief requested by several parties in earlier petitions for reconsideration. Under these circumstances, the automakers should reasonably have expected that the Commission might grant that relief.

III. THE AUTOMAKERS' CLAIMS OF POTENTIAL INTERFERENCE ARE UNSUBSTANTIATED.

The substance of the automakers' argument is that the Commission incorrectly characterized its relaxation of U-NII-3 emissions as "slight,"[12] and that these increased emissions will somehow cause harmful interference to DSRC.[13] But the automakers' disagreement with the Commission's choice of words does not warrant reconsideration when, as in this case, the Commission based its ultimate conclusions on careful consideration of an extensive record.[14]

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[12] Second Automaker Petition at 6-7.

[13] *Id.* at 15-17.

[14] *See, e.g.*, *Application of BHC Associates, Ltd. Partnership (Assignor) & Big Horn Communications, Inc. (Assignee) for Consent to Assign the Construction Permit for Station KPQD-TV, Channel 6, Billings, Montana*, Memorandum Opinion and Order, 7 FCC Rcd.

And, in any event, the Commission was correct that real OOBE under its current rules will be no higher than they were under the previous Section 15.247 rules, and that these emissions will not cause harmful interference to DSRC.

For real-world U-NII-3 devices operating in an 80 MHz channel, actual OOBE performance would be dominated by the need to reduce emissions below -27 dBm/MHz at a certain distance from the band edge.[15] This strict limit is common to both the existing limits and those that the Commission adopted in the 2014 Order. By contrast, the previous Section 15.247 limits[16] provided, for non-point-to-point devices, an ultimate OOBE floor of only 3 dBm/MHz at *any* distance from the band edge. Thus, under both the current rules and the rules the Commission adopted in 2014 prior to reconsideration, an 80 MHz channel U-NII-3 device design would be dominated by IEEE 802.11 standard mask requirements and the need to comply with the 30 dB reduction in permissible OOBE required at the outer extremes of the U-NII-3 OOBE mask (i.e., 5650 MHz and 5925 MHz). Based on this requirement, there is only limited room for actual device variation in emissions patterns into channel 172. Thus, from an engineering perspective, the current U-NII-3 mask would allow at most only a slight increase in OOBE into U-NII-4 relative to the previously adopted 2014 Order, given that they share the single most restrictive limit: 80 MHz bandwidth waveform compliance with the 802.11 standard and a -27 dBm/MHz emissions limit 75 MHz or more from the U-NII-3 band edge.

1950 ¶ 4 (1992) ("It is well established that reconsideration will not be granted merely for the purpose of rearguing matters fully evaluated and discussed by the Commission in its previous action.").

15 2014 Order ¶ 90.

16 47 C.F.R. § 15.247(d).

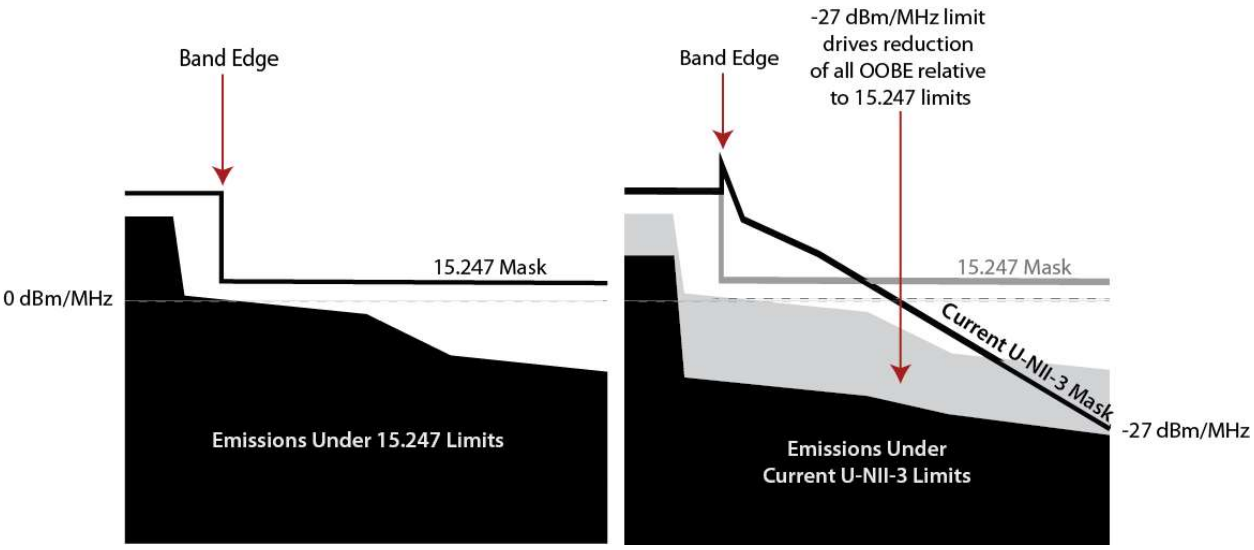

Figure 1 Comparison of typical 802.11 waveforms of an 80 MHz channel under 15.247 and current U-NII-3 rules.

The automakers also attempt to show that the 2016 Order would allow U-NII-3 OOBE limits to exceed the permitted emissions from devices operating under the Section 15.247 rules, which govern the operations of hundreds of millions of Wi-Fi devices already deployed in the US. But this is incorrect for two independent reasons.

First, OOBE for point-to-point U-NII-3 devices were essentially unlimited under the previous Section 15.247 rules. Those rules imposed no in-band radiated power limits[17] and only required that OOBE be kept to 20 dB below in-band power in any 100 kHz.[18] Thus, the previous rules enabled point-to-point operations to increase both in-band and out-of-band emissions without limit through the use of higher gain antennas. In contrast, the current OOBE rules

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[17] 47 C.F.R. § 15.247(c)(1)(ii).

[18] 47 C.F.R. § 15.247(d).

impose fixed limits for all types of devices, regardless of in-band power, meaning that the current limits are necessarily more restrictive for devices with sufficiently high in-band radiated power levels. The Commission was correct to observe that "DSRC systems will receive greater interference protection under the emission mask adopted in [its 2016 Order] than was provided under the old rules" for this reason alone.[19]

Second, as explained above,[20] the fact that the current OOBE limits decrease to -27 dBm/MHz, in combination with waveform restrictions imposed by the IEEE 802.11 standard, means that, from a practical engineering perspective, "adopting more stringent limits for the newly modified Section 15.407 rules would reduce the OOBE from each U-NII-3 device and, in turn, should reduce the aggregate emissions from these devices."[21] The need to comply with this new -27 dBm/MHz limit—30 dB below the previous limit even for non-point-to-point devices—means that real-world OOBE from 20, 40, and 80 MHz bandwidth 802.11 devices will be lower overall in the aggregate under the new limits.

For similar reasons, the automakers' analysis of interference by U-NII-3 OOBE to DSRC greatly overestimates the likelihood of interference. The automakers assume that U-NII-3 devices will transmit at the maximum OOBE power permitted under the Commission's rules at every point along the mask. But, contrary to these assumptions, it would be unheard of for a 802.11 device to so closely trace the Commission's OOBE limits. Instead, a realistic "worst case" 802.11 device could meet the Commission's OOBE limits at a few discrete points, but fall

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[19] 2016 Order ¶ 23.

[20] *See supra* pp. 6-7.

[21] 2016 Order ¶ 23.

far below the Commission's limits throughout the remainder of the U-NII-4 and U-NII-2C bands.

Indeed, engineering analysis demonstrates that IEEE 802.11 compliant devices operating in 80 MHz channels would have an actual OOBE into DSRC channel 172 of no more than -10 dBm/10 MHz,[22] below the limits the automakers request in their petition.[23] This is a result of practical engineering constraints that prevent manufacturers from controlling emissions in a manner that corresponds precisely to the limits of each point in a mathematically defined set of lines in an OOBE mask, as well as the need to comply with the highly restrictive -27 dBm/MHz limit beyond the mask edge under the existing mask.

Therefore, even if the Commission were to accept several largely unexplained assumptions the automakers have made—such as DSRC interference sensitivity,[24] propagation environment,[25] DSRC modulation type and data rate,[26] etc.—the automakers have not established that DSRC will experience any harmful interference from real 802.11 compliant devices operating under the Commission's new OOBE mask or under previous masks. This is confirmed by the evident lack of interference from U-NII-3 devices operating under the Commission's previous Section 15.247 rules which, in real engineering terms, allowed manufacturers to produce devices with significantly greater OOBE.

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22 *See* Declaration of Gary Wong, *infra* Appendix A ¶ 6 ("Wong Declaration").

23 Second Automaker Petition at 17.

24 *Id.* at 15.

25 *Id.* at 16.

26 *Id.* at 15.

IV. THE AUTOMAKERS' PROPOSED OOBE LIMITS WOULD SIGNIFICANTLY HARM UNLICENSED OPERATIONS IN U-NII-3 WITHOUT A DEMONSTRATED BENEFIT TO DSRC.

As the record already reflects,[27] the current U-NII-3 OOBE limits present a serious engineering challenge for many makers of Wi-Fi equipment in the U-NII-3 band. The existing U-NII-3 mask already requires many Wi-Fi devices to reduce power in order to prevent spurious emissions from exceeding the low limits adopted to protect Terminal Doppler Weather Radar systems. This limit also ensures reduced emissions into the DSRC band, especially for the higher-capacity 80 MHz channel, Wi-Fi channel 155.

But while the existing mask requires some power reduction or other engineering tradeoffs, the automakers' proposed mask would require many categories of Wi-Fi devices to reduce power by another roughly 6 dB to meet the very sharp drop off that the automakers' proposed mask would impose beginning at 5750 MHz.[28] Such a large drop in power would decrease Wi-Fi range by 25-50%, significantly impairing typical Wi-Fi devices certified to use this band.

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[27] Broadcom Letter, Attachment at 2.

[28] *See* Wong Declaration ¶ 7.

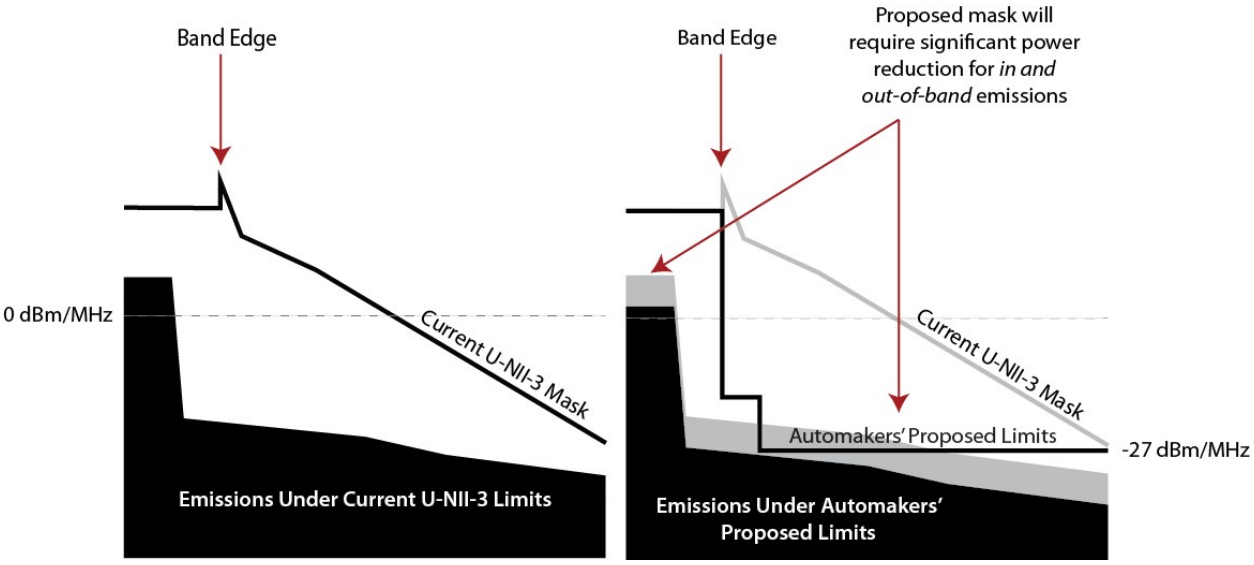

Figure 2 Automakers' proposed mask would require across the board power reductions to comply with -27 dBm/MHz ceiling, to comply with extremely sharp initial drop-off, and to avoid mask 'corners' at 0 MHz and 10 MHz from the band edge.

This means that a large portion of future Wi-Fi deployments in U-NII-3—the most heavily used 5 GHz Wi-Fi band—would be unjustifiably impaired.

The Commission can avoid this outcome, however, even if it were to credit automakers' unsubstantiated concerns about interference to DSRC. The automakers could simply relocate operations currently planned for channel 172 to the top of the DSRC band. Under the Commission's current U-NII-3 mask, DSRC channel 182 would receive absolute worst-case interference of only -5.8 dBm/10 MHz from U-NII-3. This is far more protection than *any* DSRC channel, including channel 172, had under the previous Section 15.247 rules.[29] The current OOBE mask ensures that V2V crash-avoidance applications would receive similar protections in any of the top three DSRC channels. While drastic changes to the U-NII-3 OOBE rules would potentially strand much of the substantial investments already made in Wi-Fi equipment and Wi-

[29] 47 C.F.R. § 15.247(d).

Fi chips, relocating V2V and other crash-avoidance operations to the top of the 5.9 GHz band would entail dramatically fewer costs due to the small number of DSRC devices in the field and under development.

V. CONCLUSION

The automakers' second petition for reconsideration is procedurally flawed and substantively unfounded. This petition merely re-argues the same points the automakers made in their first petition for reconsideration, in FCC filings, and in ex parte meetings, this time simply directing these arguments at the Commission's newly adopted OOBE limits—an operating parameter on which they have already enjoyed several opportunities to comment. This is plainly not a basis for reconsideration. Even if this were not the case, the automakers have failed to refute the Commission's stated rationale for adopting the current limits. The new limits will hold real-world devices to lower levels than the Section 15.247 limits that have applied long before the Commission even instituted this proceeding.

DSRC systems that could not operate in the presence of the real-world OOBE under the current rules also could not have operated under the previously applicable Section 15.247 rules. If this is the case, it can be attributed only to DSRC proponents' decision to design a system that

cannot operate in a spectral environment that has now existed for over a decade. This may be a good reason for DSRC proponents to reconsider their reliance on channel 172 for V2V safety messages, but it cannot be a reason to rewrite the U-NII-3 OOBE rules, creating substantial harm to Wi-Fi that rely extensively on the U-NII-3 band.

Respectfully submitted,

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APPENDIX A

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In the Matter of Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band	ET Docket No. 13-49

DECLARATION OF GARY WONG

1. My name is Gary Wong. I am a Principal Compliance Engineer for Broadcom Ltd. My responsibilities include regulatory compliance and certifications of radio designs. This includes extensive work, reviewing, interpreting, testing and complying with global certification requirements related to the import, marketing, and/or use of wireless LAN products including the IEEE 802.11 family.
2. I am familiar with the Commission's out-of-band emissions ("OOBE") rules for unlicensed operations in the U-NII-3 band, and the effects of those regulatory limits on the design of real-world 802.11 devices.
3. I am also familiar with other restrictions, including engineering and standards-based restrictions, on 802.11 waveforms and the consequent OOBE levels.
4. I have reviewed the petition for reconsideration filed by the Association of Global Automakers and the Alliance of Automobile Manufacturers in this proceeding. I have

evaluated the claims made in that filing, and the likely effects of the regulatory proposals included in that petition.

5. According to my analysis of the Commission's current rules for OOBE from unlicensed operations in U-NII-3, these rules would permit, at most, only a slight increase in real-world OOBE from an 80 MHz 802.11 device into DSRC channel 172 relative to those the Commission adopted in its 2014 Order. The current rules will likely result in a real-world decrease in emissions from 20, 40, and 80 MHz bandwidth 802.11 systems into U-NII-4 DSRC channels when compared to 15.247 rules because of the -27 dBm/MHz floor at 5925 MHz.
6. For 802.11 devices using an 80 MHz channel, these emissions into DSRC channel 172 would likely not exceed -10 dBm/10 MHz. This is due primarily to waveform restrictions imposed by the 802.11 standard itself, as well as other engineering limitations.
7. The emissions mask petitioners propose, however, would seriously restrict these operations, requiring further power reduction of approximately 6 dB in certain segments, reducing range by 25-50%.

I, Gary Wong, declare under penalty of perjury that the foregoing declaration is true and correct. Executed on June 23, 2016.

Respectfully submitted,

Gary Wong
Principal Compliance Engineer
BROADCOM LTD

CERTIFICATE OF SERVICE

I, Jessica Parent, do hereby certify that on this 23rd day of June, 2016, I caused a copy of the foregoing Opposition to Petition for Reconsideration of the Association of Global Automakers and the Alliance of Automobile Manufacturers to be served by postage pre-paid mail on the following:

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